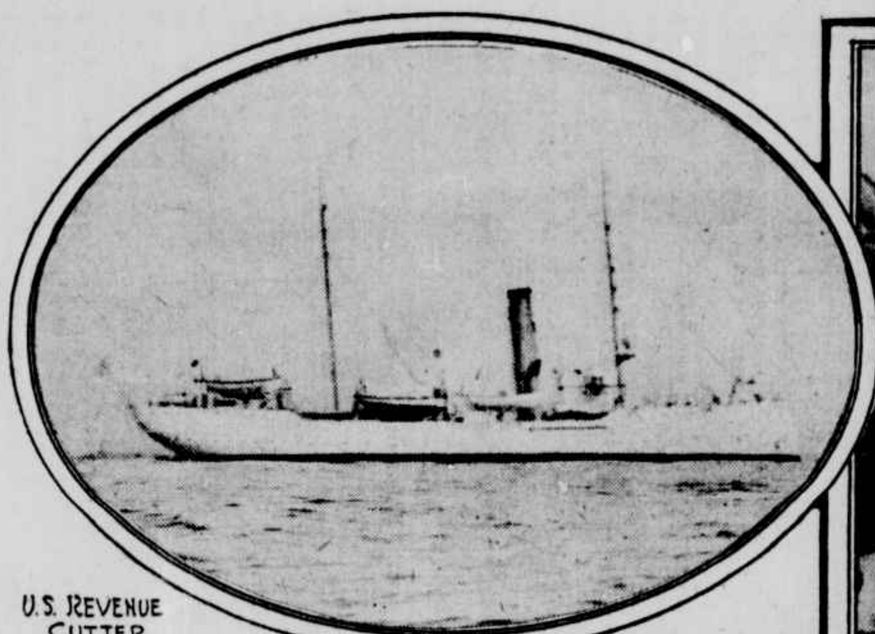
A PLUNGE INTO SEA'S DEPTHS TO SHATTER A WRECK

How Larson, of the Revenue Cutter Mohawk Removed Ocean Peril.

A Hundred Feet Below Surface Without Life Line or Air Pump.



U.S. REVENUE CUTTER MOHAWK

THE CREW AT REST AFTER BLOWING UP THE WRECK.

DIVER JUST AFTER REACHING SURFACE

ONE OF THE DIVERS AND HIS EQUIPMENT INCLUDING TELEPHONE APPARATUS

ON Sunday, May 17, when all Norway was rocking with joy bells at the centennial of Norwegian independence, the sailors of the United States revenue cutter Mohawk were blowing to pieces the good Norwegian bark Orellana, that had sunk last month in seventeen fathoms of water, twenty miles off Barnegat, out in the Atlantic.

The bark's topgallant masts were all that showed above the hundred feet of sea. Shipmasters shivered as they grazed by this uncharted danger to their boats. The United States Lighthouse Service sent out a buoy to mark by day and a light by night the nasty menace. Even after that was done an excited mariner reported a wreck with a light flashing red near it. Skippers grew nervous. It was a disturbing element on the ocean highway. The hulk of the wreck was deep enough, but the masts might puncture the bottom of many a ship pitching and rolling on the seas.

The Mohawk, Captain Van Boskerck commanding, was detailed by the Revenue Cutter Service to remove this obstruction to navigation. And as the Mohawk, like the other coast police ships, attracts to itself the lads from Scandinavia, that is why Norway's century of freedom was celebrated by Norwegian-Americans firing guncotton mines.

THIS DERELICT A DEEP SEA DIVER'S JOB.

It was a deep sea diver's job. And when the conditions away down in that tangled mass of rigging were reported it was up to the ordnance officer of the Mohawk.

The Mohawk had the ordinary diving outfit, and her gunner, Larson, is her diver. But Larson knew of the latest diving dress that European divers use, one that needed no air pump, life line or pipe. He had never used it, so the captain of the cutter secured G. D. Stillson, deep sea diver of the United States navy, and his assistant, S. J. Dellishak, to go with the Mohawk and use the emergency suit. Stillson's record is 253 feet and Dellishak's 246. The former is the world's record, accomplished by enduring a pressure of 113 pounds to the square inch.

The self-contained diving dress used by these divers on the Mohawk was reinforced by attaching to it a special air cylinder used to inflate the suit. In place of back weights, cylinders of air and oxygen (50-50) compressed to 120 atmospheres are annexed, and also a box jacketed with air to prevent loss of heat and containing cartridges of caustic soda. The granulated soda is arranged in trays so that the air current passes over each tray. The oxygen mixture escapes through a reducing valve at five litres a minute, and then through an injector apparatus set on the inlet tube leading into the helmet. The force of the oxygen acting on the injector sucks the air from the helmet through the outlet pipe and soda cartridges, and so frees the air from the exhaled CO^2. The supply of manufactured air is intended to last from thirty minutes to an hour. The oxygen mixture is safe to breathe down to a depth of from 70 to 100 feet. Pure oxygen would bring about oxygen poisoning, so the 50 per cent mixture is necessary. Four hours out from the Ambrose Channel, in the open ocean, with not a sail in sight, the cutter cast anchor near the buoy flashing red and the gaunt topgallant masts that marked where the bark from Norway lay on the bottom, weighed down with its potter's clay that had come all the way from Boulogne.

A ship's launch, manned by the Mohawk's sailors, carried Ordnance Officer Ryan, Gunner Larson and Diver Stillson and his mate, Dellishak, over the wreck. Making fast to the mizzen topmast, they cast the lead. It showed 11 fathoms to the poop deck, 12 to the main and 13 to the fore deck of the buried bark. The divers could see hard work before them, as even the lead had difficulty in reaching the deck of the unlucky three-master, so afoul of shrouds and floating wreckage did it get.

Early the following morning, before clerks and millionaires were awake, two boatloads of revenue cutter tars were on the job, rising up and down on the Atlantic's swells 70 feet above the Orellana's decks. The Mohawk moved away from her anchorage of the night before. Guncotton and detonators in large amounts on board might be unduly jarred by the blasts that must be fired to loosen the bark's steel masts.

THE WRECKED SHIP A GHOSTLY SIGHT.

It was a ghostly sight to peer down into the dark, green water from the bobbing boats and see the shrouds and stays and spars of this full rigged ship reaching into depths that human beings had not explored. It was even more ghostly, out there on the wild seas, to watch the diver, clad in his uncanny looking helmet and armored plates, with his cylinders of chemicals attached, shod in leaden shoes, being helped by his mates off the stern of the little launch, down the short, swaying ladder into the sea. His assistant stood in the boat, with telephone receiver at his ear and transmitter at his lips, talking to the entombed diver as he went down.

The telephone is of little avail with the ordinary diving suit that depends upon air pumped from above in deep sea work. The noises in the helmet soon preclude his hearing any message from above. He must depend on his signal cord. Less than a dozen signs with it are possible. But with the modern apparatus, making his own atmosphere, purifying his own air, regulating his own pressure, he is able to hear as if he were up in the boat.

From the very minute the diver was submerged, his mate kept up a running conversation until he appeared again sixteen minutes later. The telephone worked so well that the men in both boats heard all the confab. The telephone wire was wrapped in a 2-inch cable of tanned rope that acted as a stay going down and a guide coming up, fastened as it was to the helmet. No other connection had he to depend on or keep him from going adrift, although these divers took down with them one end of the cord to be fastened t th: base of the mast, so the mine could be lowered later down this cord to the spot seventy feet below.

Once below the surface, the leaden boots and heavy helmet became light. The air in his suit displaced so much water that he fairly floated down at his ease. The officers and seamen watched the monstrosity sink through the clear, dark ocean under their boats until it looked like a light green wraith and disappeared in the deeps lower down. It was like slipping a friend into a bottomless grave. The only satisfaction left to those above was the constant dialogue distinctly heard.

"Can you see much?"

"Fine, fine."

"Where are you?"

"At the head of the davits."

"Sing out if you want anything."

"Take in a little bit of slack for me, so that I can feel it. Hold that, now. That's better. That's better. That's fine."

"You are going down fine, old man."

"Now, I'm clear to the rail (seventy-two feet). Hang on to me. Now I'm standing on the mainyard."

"How are you? Are you going to be able to get clear down?"

"Yes, I'm down now. I'm at the capstan, 'midship. Her deck is covered with an awful lot of junk. Let me have more line."

"We can't give you any more. It's in a bight here now. It's the tide pulling it on you. Can you get to the main mast?"

"Yes, soon as I get clear of all this junk here."

And so the talk went on. It was uncanny. The man had disappeared into the depths. The men in the boats heard only his voice.

"How much air have you got left?"

"Fifteen, yet."

And by that all knew that six-sevenths of the 105 atmospheres with which the oxygen cylinder was charged had been used up. The diver had only one-seventh of this thirty or forty minutes to live.

"Be careful, now, that you can get back."

"Lower away," was the answer.

"Say when," said the man in the boat, as the line was told off.

"O. K. Let me have more slack. Haul in now. Lower away again. I want to go across the deck."

After that came the announcement that he had made the cord fast at the base of the mast. "Come up slowly," sang out the assistant. "Careful, now, careful; don't come up too fast."

It is the decompression that kills. It is the decompression that brings on that terror of all compressed air workers, the "bends," the caisson disease.

The diver, away down on the decks of the Orellana, inflated his suit slowly, and without any help from the men in the boat, save their careful guiding of his telephone cable, came up like a slowly rising bubble. "There he comes!" shouts a son of Norway. The seamen in the boats risk their necks by leaning clear over the gunwales to catch sight of the ghastly garb of the man who went to the bottom of the sea. It is the work of a moment to grab him as the monster helmet bobs up at the very stern of the boat. The unnatural figure is dragged in quickly, so that the casque may be removed. In a jiffy the diver is gasping in the ozone that is as free above as it was scarce below.

It takes a real man to be a deep-sea diver. If he has any organic weaknesses, if his heart is weak, if he has the kitten breath, if his arteries are a bit inflexible, if his eustachian tube from mouth and nose to ear is swollen or choked, he has small chance. The self-contained diving dress, with its oxygen treatment, is a sure cure for catarrh. If you have nothing else the matter with you it is a safe risk. And now the ordnance officer gives his orders. Two mines are connected to the insulated cable on a reel in the launch. The mines are dropped carefully into the water, noosed to the cord that now extends from the launch straight down to the heel of the mast, where the deep-sea diver placed it. As the mines slip away down on their deadly mission the insulated wire is paid off the reel until the ordnance officer feels that the shots are at the deck. The launches pull away, the one having the ordnance officer and the reel paying off its cable as the sailors bend to the oars.

Several hundred feet away from the wreck the boats take their position. Half a mile away rides the Mohawk. The ordnance officer stands up in his launch and waves his cap. Then comes an ear-splitting crack, a ripping split, just as when a bolt of lightning strikes an old oak tree. With it comes a smothered crash and a jar. The boats shiver from the concussion that detonates like a 12-inch gun. It doesn't send a geyser into the air. No deep-sea shots do that. When you see a geyser of water rising like a Niagara into the air depend on it that the shot was close to the surface, or else was a whole magazine of explosives. No single mine (fifty-six pounds) can force seventy feet of water—solid ocean water—very far into the air.

AFTER THE MINES HAVE BEEN EXPLODED.

And these deep-sea shots didn't. A spar or two jabbed its way to the surface. A spitting, a boiling and a churning went on for many seconds over the wreck. It would have been an unhealthy place for the Mohawk's boats at the moment. But a Hackensack skiff could have easily ridden fifty feet away without danger of capsizing.

Not so with the later shots, for the old Norway bark refused to let go its steel masts. They had to be torn out by degrees. Her rigging was not shoddy stuff. The stays were the best of cable. The ratlines and shrouds were knit for service, so that the mines that were placed higher on her masts later in the day not only tore them off, but made waterspouts of beauty.

Back to the wreck flew the boats as soon as the swirling and whipping sea became normal. When the mizzenmast went down the main topgallant mast was attacked. Then the foremast had to succumb. Her bowsprit could not be seen and soundings failed later in the day not only tore them off by the Peter Crowell when she rammed the bark that April night.

And after the explosions, often many minutes after, the sea was speckled with the gleaming bellies of rock cod and hake, sea trout and bass, stunned at the bottom of the ocean and suffering from the bends as they were subjected to rapid decompression by being forced quickly from the deeps to the surface.

The Lighthouse Service has brought in its "buoy flashing red." The hydrographic office has rubbed off of the Atlantic charts the temporary sign of the wreck of the Norwegian bark, for the Revenue Cutter Service has reported that that obstruction to navigation is removed.

UNIQUE FEAT DOUBLED STRENGTH OF WILLIAMSBURG BRIDGE

THE development of New York's great subway system has tested the ability of some of New York's engineers in an interesting way. Recently the public learned of the accomplishment of a feat by the engineers of the Bridge Department which has been described as unprecedented. It was a detail of the work of reconstructing the Williamsburg Bridge so that the ponderous ten-car steel trains of the Coney Island subway and the enormous twenty-ton commercial trucks which have come into use in recent years could cross it without danger. The work was begun three years ago, and after the expenditure of approximately $750,000 the bridge will soon be in a condition to withstand the increased strain of public and vehicular traffic and meet the demands of the dual subway system.

The unprecedented feat was that of replacing four ten-inch pins connecting the land spans and the towers with the same number of thirteen-inch pins. Two of the pins have already been changed for the larger and stronger ones.

"In the midst of the subway negotiations between the city and the traction companies," said Commissioner Kracke, "it was discovered that the bridge, the second longest in the world, was not strong enough to carry its capacity of travel. On the main span the bridge had a supporting strength of 4,500 pounds a linear foot. At the end spans it had a supporting strength of 8,000 pounds a linear foot. This weight is live load, the engineering term used to mean anything except the dead weight of the bridge itself. It meant people who wanted to walk across the bridge, it meant vehicles of all sorts, it meant trolley cars. Last and most important, it meant elevated cars or subway cars or trains.

"Now, this is engineering talk, but it is simple enough if stated another way. An elevated train or a subway trains weighs approximately 2,000 pounds to the linear foot. A surface car weighs 1,500 pounds to the linear foot. Vehicular traffic is estimated at 100 pounds to the square foot.

"The bridge was equipped with four tracks for surface cars and two tracks for elevated and subway cars. But if four trolleys and two elevated cars passed any given point on the main span at one time that point would be supporting 10,000 pounds of weight on 4,500 pounds of strength, or 5,500 pounds a linear foot more than it was built to support, or 122 plus per cent of overload. The only salvation of the situation was that travel on the bridge was not excessively heavy and arrangements for any extended elevated service had not been made. But something had to be done, and be done quickly. So the Bridge Department set to work.

"There was no time to be lost. The Mayor of the city, the members of the Board of Estimate, the members of the Public Service Commission and the engineering authorities had their eyes on the bridge. It was the northern extremity of the Centre st. loop of the new subway system which was to carry downtown to the Municipal Building and to the financial district the passengers of the Brooklyn elevated lines. It was being pointed out as the natural outlet for the three-tracked Broadway and Myrtle av. lines in Brooklyn. It stood between the Brooklyn and Manhattan Bridges and the proposed East River tunnels and the Queensboro Bridge, a midway point on the big subway system. It had to be made strong."

It was not difficult to erect the additional towers to support the landward spans. This was a simple matter. Two props were added to the one weak looking steel support already in service. This gave three steel props to the span where before there had been only one. In addition the engineers braced the whole structure by crossing heavy iron girders under the roadways and tracks. It was only within the last two months and at the instance of Commissioner Kracke that the engineers solved the big problem of the reconstruction programme. This was the removal of the bridge anchor pins and the substitution of stronger ones. This was the one novel and extraordinary feature of the whole work of reconstruction.

The anchor pins of the Williamsburg Bridge tie the members of girders of the shoreward span to the land side of the main towers. The end spans of the bridge were supported from the towers by iron bolts or pins, 10 inches in diameter and weighing 1,000 pounds. These have now been replaced by monster nickel-steel pins, 13 inches in diameter and weighing 1,800 pounds. Briefly stated, the accomplishment of this task required the pulling out of the old pins and the tying of the disjointed end spans rigidly to the tower while the 10-inch hole was being enlarged sufficiently to admit the insertion of a pin 13 inches in diameter and 40 inches long.

No similar engineering work of this magnitude has ever been done befoce. The special drilling machine used was designed by the engineers of the bridge department. The gigantic drill had a boring head with seven self-hardening steel cutters adjusted to bore out a chip of metal one-eighth of an inch deeper and three-sevenths of an inch wider than the previous cutter at each revolution. The steel-cutting knives were driven by a 100-horsepower motor which was fed by current from the third rail. It cost $5,000 to construct this machine.

"The machine, as finally worked out, looks something like a rapid-fire gun of the type that projected from the barbettes of the old-style battleships," said the Bridge Commissioner. "It had a long barrel-like cylinder, which was fitted into the 10-inch hole after the old pin was removed. Back of this came the cutting head. There were seven teeth in this. They lay back of one another in such a way as to bite at an angle. The depth to which they bit into the steel could be regulated. A feature of the machine is that it is made of a specially prepared steel which tempers itself as it heats from friction so that the blades do not lose their cutting edge.

"The actual operation of collapsing each of the 10-inch pins and substituting the huge nickel-steel pins consumed a little over three days. The most extraordinary part of the feat, which was unheard of in engineering circles, was performed with practically no disturbance of the day traffic over the bridge. The removal of the bridge anchor pins and the substitution of the stronger ones was the big problem which confronted us."

The safety of the bridge following the removal of the anchor pins and prior to the insertion of the larger pins was secured by the engineers through specially constructed supporters designed to carry all of the strain on the upper land-span or course of girders. The first huge pin was driven in the tower on the New York side of the bridge on April 12. During the operation the bridge was closed to all except pedestrian traffic between the hours of 1 and 5:50 o'clock in the morning.

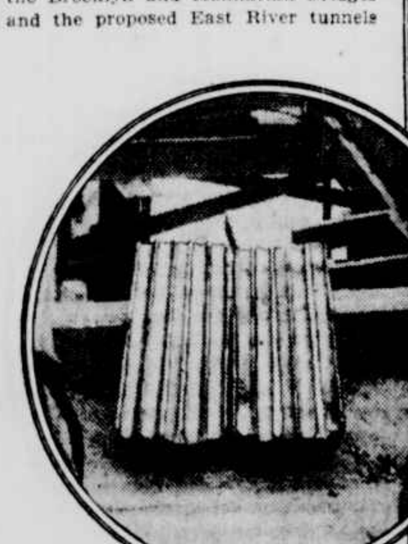
The bori. g, or cutting, machine was adjusted in position at 1:44 a. m., and was connected to the third rail of the elevated track, from which it got its motive power. It worked with remarkable success, and its operation completely justified all of the expectations of the department engineers. Only one hour and three minutes was required to bore the 13-inch hole. This was the equivalent of removing 360 pounds of structural steel by boring. An additional fifty-seven minutes was consumed in finishing and dressing the new hole for its extension of 24 inches through three added solid steel girders. The new pin was then placed in the hole and driven in by a ram, operated derrick fashion, from an upper steel beam of the bridge truss. The entire operation was completed and the bridge was opened to traffic in less than five hours.

"The second of the big pins," said Mr. Kracke, "on the Manhattan side was put in on the morning of April 26 in still quicker time. The machine was adjusted by 1:30 o'clock, and the actual cutting time for making the 13-inch hole was only fifty-six minutes. The success of the operation on the Manhattan side of the bridge left no doubt of the outcome when the Brooklyn spans were reached. The fourth and last pin was put in early Friday morning.

"The type of the bridge has been entirely changed. As originally planned, the bridge, in the vernacular of the engineer, was a suspension bridge with cantilever shore spans. These have been converted now into trestle spans.

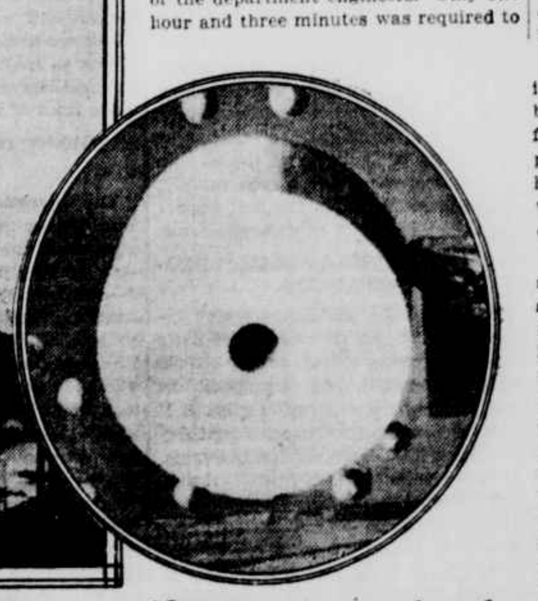
"Mayor Mitchel is keenly interested in the strengthening of the Williamsburg Bridge, because it is an integral factor of prime importance in the plans for the dual subway system. He has already held several conferences with me and my consulting engineers on this vital matter.

"The bridge is now 100 per cent stronger than it was when the reconstruction work was begun in the summer of 1911. From having a supporting strength of 8,000 pounds a linear foot on the shore spans and 4,500 pounds on the main spans, the anchorage spans will have a supporting strength of 16,000 pounds, and the main span will have a supporting strength of 12,000 pounds. This means that if the two subway cars and four surface cars should pass a given point at the same time with their live load of 10,000 pounds, the bridge at that point would have a supporting strength far in excess of the peak load possible in the cars."



Old 10 inch pin in two sections

Williamsburg Bridge showing where pin was inserted



New 13 inch pin placed in bridge